

# Curriculum for Training X-ray Film Readers For Mass Surveys

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**C**HEST X-RAY survey programs are conducted periodically in the United States by both public and private institutions. Since good film interpretation is essential to the effective operation of these programs, the Public Health Service has, in the past few years, developed a film reader training course.

It should be understood that such a training program prepares physicians only for the screening out of chest abnormalities and that patients so selected are referred to private physicians or health agencies for definitive diagnosis and treatment. Candidates for the course must have a medical degree from an approved medical school and at least 1 year of approved internship.

The training period may last only a few days, or it may take from 6 to 8 weeks depending upon the needs and the previous experience of the trainees. Individuals must measure up to established standards of performance.

## The Course and Materials

Each student must thoroughly study Pendergrass and Hodes' article, *The Healthy Chest (1)*. A series of 14- x 17-inch normal chest films is shown to the students. As a rule, the series consists of 5 or 6 normal chest X-rays of male and female patients of varying stature. Parts of the normal chest, the soft tissues, bony

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skeleton, heart, great vessels, and lung parenchyma are examined on the X-ray films. For purposes of discussion, each of these structures is outlined so as to be distinguishable from surrounding organs. A full 2-hour period is usually allotted to the discussion and examination of the healthy chest.

Students must learn to identify anterior and posterior ribs, ascending aorta, sternoclavicular junction, and other such structures. Deviations from normal anatomy which are not considered pathological in normal cardiorespiratory function are demonstrated. Since most of the student readers will eventually handle the survey type of X-ray film, they must be able to recognize artefacts and any other factors which increase the difficulty of accurately interpreting normal roentgenograms. For this purpose a roll of 70-mm. chest films with normal variants and selected pathology is presented and studied. Examples of cervical ribs, bifid ribs, and other bony anomalies are included on the film. The osteoma, azygos lobe, calcified nodes, dextrocardia, situs inversus, and unilateral and bilateral mastectomy are other items on the film. Metal fasteners, breast prosthesis, nonopaque costume jewelry, and form molding devices are shown. Good examples of interesting pathology clearly evident on the X-ray make up part of the collection. Some such examples are hiatus hernia, pericardial effusion, von Recklinghausen's neurofibromatosis, and silicosis.

Another of the materials used in the training course is a roll of 70-mm. chest films showing the normal heart, organic heart disease, and congenital heart disease. Interpretation of the heart shadow does not receive major emphasis in the standard film readers' course, but increasing awareness of the presence of heart disease, particularly in middle-aged individuals, demands that the chest film reader of today be adept at interpreting the more obvious heart abnormalities and that he avoid false positive readings wherever possible. It would be impractical to devote much time to the differential diagnosis of heart disease in a course of this kind since experts frequently need more than

a single posteroanterior film for accurate interpretation. However, during the short period of time which is devoted to organic and congenital heart disease, diagrams and heart models are used to explain the methods of evaluation.

After the student is familiar with the normal chest structures and the more common deviations from the norm, he is given a general review of chest pathology. A roll of 70-mm. chest films showing various kinds of pathology and including most of the common and many of the rarer lung lesions is discussed. Lesions appearing in minimal tuberculosis, bronchogenic carcinoma, lobar pneumonia, arteriovenous fistula, and beryllium inhalation are observed. Whenever possible the technique of differential interpretation of a given lesion is discussed. No film reader is expected, however, to achieve 100 percent accuracy in differential roentgen interpretation. Larger, 14- x 17-inch, films showing common and rare chest lesions are used for purposes of emphasis. Actual survey conditions are reproduced, and the student is asked to interpret both a large number of 70-mm. films taken from past surveys and the 14- x 17-inch confirmatory films. Through this experience the student learns that the difference in appearance of identical lesions on large and small films is only slight.

In the past, screening programs have been primarily concerned with the discovery of pulmonary tuberculosis. For this reason 14- x 17-inch films of pulmonary tuberculosis are thoroughly examined, and the nature and appearance of the disease in all of its forms and in every age group is studied. The ever-increasing awareness of the prevalence of lung cancer and the probable association of some solitary round lesions of the lung with pulmonary cancer has prompted the inclusion of a special session devoted entirely to this subject.

In the film reader course individual supervision is always desirable. However, in large classes this must sometimes be subordinated to the achievement of group coverage. Projection devices are best suited to large groups. Since this is so, it is more convenient when working with such a group to use a roll of miniature film, which can later be adapted for use in individual viewers, than it is to assemble

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### Sample Chest Film Reader Orientation Course

(20-day course, 2 periods daily)

1. The X-ray—a brief orientation on the production and nature of X-rays:
    - a. Physical aspects..... 1 period.
    - b. Teleroentgenography and the advantages of positioning..... 1/2 period.
    - c. Photofluorography and fluoroscopy..... 1/2 period.
  2. The healthy chest:
    - a. Normal 14- x 17-inch films.. 1 period.
    - b. Normal 70-mm. films..... 1 period.
    - c. Survey of deviation from average normal..... 1 period.
    - d. The heart—including normal contours, physiology, and pathological anatomy... 1 period.
  3. The pathological chest:
    - a. Survey of various kinds of chest pathology..... 3 periods.
    - b. Tuberculosis—primary and reinfection types..... 3 periods.
  4. Film interpretation:
    - a. 70-mm. film reading and 14- x 17-inch confirmation..... 24 periods.
  5. Reader efficiency testing..... 4 periods.
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large numbers of glass slides, which may be used for projection purposes only. The projection of roll film is accomplished by the use of an insert which, when fitted on a conventional slide projector, serves as the holder for the roll film. One roll contains enough material for an entire teaching session. As many as 400 individual pictures can be put on a single roll of film, the weight of which is hardly more than that of 12 projection slides. The advantage of this technique in terms of bulk alone is tremendous.

### Evaluating the Training

One means of evaluating the film reader training program is by testing reader efficiency. Each trainee is tested in film reading ability at the beginning of the course, halfway through

the course, and upon its completion. In this way, the relative rate of progress is measured and individual weaknesses are highlighted.

X-rays from past surveys are used in the test. Each has been clinically evaluated and positive and negative cases proved so far as possible. After each test, films are reviewed, and trainees have an opportunity to examine closely the films they are most likely to misinterpret. Although the same films are used for each test, the danger of students' remembering the correct interpretation of the films from one test to the next is negligible. Since actual survey conditions are reproduced for testing, there are included among the films used some radiographically positive cases which were proved clinically negative and some radiographically negative cases which were proved clinically positive. Students are scored on their ability to make accurate interpretations on the basis of radiographic evidence only.

### Summary

Candidates for the course in reading miniature chest X-ray films must have a medical degree from an approved medical school and at least 1 year of approved internship. The course prepares physicians only for the screening out of chest abnormalities.

The materials used in the film reader course consist of a series of normal 14- x 17-inch chest X-ray films; a roll of 70-mm. chest films with normal variants and selected pathology; a roll of 70-mm. chest films showing the normal heart, organic heart disease, congenital heart disease, and copied diagrams; a roll of 70-mm. chest films depicting various kinds of chest pathology; 14- x 17-inch films from museum files containing typical examples of most of the common and some rare chest lesions; 70-mm. films taken from past surveys with the 14- x 17-inch confirmatory film for each case; selected groups of 14- x 17-inch films showing the various forms of pulmonary tuberculosis; 3-dimensional rubber (2) and 2-dimensional plastic heart (3) models; and a specially designed adapter which converts a slide projector to a 70-mm. roll film projector.

### REFERENCES

- (1) Pendergrass, E. P., and Hodes, P. J.: The healthy chest. *Am. J. Roentgenol.* 38: 15-41 (July 1937).
- (2) Butterworth, J. S., and Poindexter, C. A.: Visual and auditory educational aids in cardiology. *J. Med. Educ.* 27: 258-267 (July 1952, part 1).
- (3) Brodeur, A. E.: A manikin to simplify the teaching of congenital heart disease. *Am. Heart J.* 44: 294-295 (1952).

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## Departmental Announcement

**John L. Harvey** was appointed, October 1954, Deputy Commissioner of the Food and Drug Administration, Department of Health, Education, and Welfare. He had been Associate Commissioner since 1951.

A member of the career civil service, Mr. Harvey started 29 years ago as a food and drug inspector at Seattle, where he was later to become chief of the Seattle station. He became chief of the western district in 1937, and when control of the FDA field activities was centralized in Washington, D. C., in 1948, he was appointed director of regulatory management.

Mr. Harvey studied law at the Jefferson College of Law in San Francisco and chemistry and bacteriology at Virginia Polytechnic Institute. He also attended Tulane University College of Medicine.